

Appl. No. 10/753,318
Amendment dated: January 11, 2006
Reply to OA of: September 12, 2005

REMARKS

Applicants have amended the claims in order to more precisely define the scope of the invention and taking into consideration the outstanding Official Action. Specifically, claims 1 and 9 have been amended to recite that the concentration of the sulfuric acid solution ranges from about 50% to about 96%. Accordingly, claims 3 and 11 have been canceled.

Claim 1 has also been amended to address the rejection of claims 1-8 under 35 U.S.C. §112, second paragraph as being indefinite. Specifically, Applicants have amended claim 1 to delete the phrase "and the un-removed portions of the electrically conductive layer". Applicants have also amended claims 1, 9 and 17 to replace the phrase "without being" with the word "not" in order to more clearly define the scope of the present invention. In light of this amendment to the claims, Applicants respectfully submit that all claims currently pending in the present application are in full compliance with all of the requirements of 35 U.S.C. §112 and are now in condition for allowance.

The rejection of claims 1, 2, 7-10, 15-16 and 18 under 35 U.S.C. §102(b) as being anticipated by Tobimatsu has been carefully considered but is most respectfully traversed in light of the amendments to the claims and the following comments.

Applicants wish to direct the Examiner's attention to MPEP § 2131 which states that to anticipate a claim, the reference must teach every element of the claim.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed Cir. 1989). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed.Cir. 1990).

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Applicants have amended claims 1 and 9 to incorporate the limitations of claims 3 and 11, respectively. Therefore, claims 1 and 9 now recite that the concentration of the sulfuric acid solution ranges from about 50% to about 96%. The Official Action impliedly acknowledges that this limitation is not disclosed or suggested by Tobimatsu. Therefore, because Tobimatsu fails to disclose every element of the presently amended claims, Applicants respectfully assert that a proper §102(b) rejection according to MPEP §2131 has not been established. Accordingly, Applicants respectfully request that this rejection be withdrawn.

The rejection of claims 1-19 under 35 U.S.C. §103(a) as being unpatentable over Baker in view of Lin has been carefully considered but is most respectfully traversed in light of the amendments to the claims and the following comments.

Applicants wish to direct the Examiner's attention to the basic requirements of a prima facie case of obviousness as set forth in the MPEP § 2143. This section states that to establish a prima facie case of obviousness, three basic criteria first must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Section 2143.03 states that all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

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Applicants also most respectfully direct the Examiner's attention to MPEP § 2144.08 (page 2100-114) wherein it is stated that Office personnel should consider all rebuttal argument and evidence presented by applicant and the citation of In re Soni for error in not considering evidence presented in the specification.

The Official Action urges that Baker discloses every element of the presently claimed invention except for an etchant comprising sulfuric acid. Specifically, the Official Action urges that Baker discloses depositing a photosensitive material over a wafer having bonding pads and an under bump metallurgy disposed thereon, forming openings in the photosensitive material, filling the openings with solder material, and removing portions of the metal layers that are not covered by the solder bumps with phosphoric acid. Applicants specifically traverse that this disclosure teaches or suggests every element of the presently amended claims.

As is clearly seen in Baker, metal layers 36, 38 and 40 are deposited over bond pads 32 (see Figure 2b). Next, Baker discloses depositing photosensitive material 42 and forming openings 44 over the bond pads 32 (see Figure 2c). Solder material 46 is then deposited in the openings, and the photosensitive material 42 is removed (see Figure 2d). As a final step, the solder bumps 48 serve as a mask while the metal layers 36, 38 and 40 are etched away using phosphoric acid solution (see Figure 2e).

The sequence of steps discloses in Baker are clearly different from the presently claimed method. In the presently claimed method, portions of the electrically conductive layer not disposed over the bonding pads are removed before forming a plurality of bumps on the un-removed portions of the electrically conductive layer. This is clearly illustrated in the drawings of the present application. Figure 5 illustrates how layers 306c and 306b are etched using a photoresist mask 308 placed over the bonding pads 302. Then, as shown in Figures 7, 8 and 9, a second photoresist 310 is deposited and openings 312 over the bonding pads 302 are formed. The openings 312 are then filled with solder material 314 and the photoresist mask 310 is subsequently removed. Thus, whereas Baker discloses etching all of the metal layers disposed over the bond pads after the solder bumps have been formed, the presently amended claims recite a

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method whereby the electrically conductive layer not disposed over the bonding pad is removed prior to forming the solder bump. Because of this significant difference between Baker and the presently claimed invention, Applicants respectfully assert that Baker clearly fails to disclose or suggest every element of the presently amended claims.

Further, Lin clearly fails to remedy this deficiency. Lin fails to disclose a method of forming a solder bump comprising the steps of removing portions of an electrically conductive layer not disposed over the bonding pads before forming a plurality of bumps on un-removed portions of the electrically conductive layer. Because Baker and Lin, either standing alone or in combination, fail to disclose or suggest every element of the presently amended claims, Applicants respectfully assert that the Official Action has failed to set forth a proper §103(a) rejection according to MPEP §2143. Accordingly, Applicants respectfully request that this rejection be withdrawn.

The Official Action also fails to explain where in Baker and/or Lin a sulfuric acid solution with a concentration range from about 50% to about 96% is disclosed or suggested. Rather, the Official Action merely urges that Baker discloses phosphoric acid as an etchant and Lin discloses a suitable solution of copper containing metal is either phosphoric acid or sulfuric acid. As explained in the specification, e.g., at paragraph [0027] and [0035], a sulfuric acid solution in this range of concentration will not easily react with the solder bumps, will make it easier to precisely control the volume of the solder bumps, will apply to both a process involving both an aluminum wafer and a copper wafer, will increase the reliability of the bumping process and finally, is not harmful to humans. Because neither Baker nor Lin, either standing alone or in combination, disclose or suggest a sulfuric acid solution ranging from about 50% to about 96% as recited in the presently amended claims, Applicants respectfully assert that the Official Action has failed to set forth a proper §103(a) rejection according to MPEP §2143. Accordingly, Applicants respectfully request that this rejection be withdrawn.

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The rejection of claims 1-3, 5-7 and 9-11 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1-10 of Tong has been carefully considered. In response, Applicants submit herewith a Terminal Disclaimer in compliance with 37 CFR §1.321(c) to overcome this rejection. The conflicting patent is commonly owned with this application. The assignee of both the present application and the Tong patent is Advanced Semiconductor Engineering, Inc.

Despite the filing herewith of the Terminal Disclaimer, Applicants would like to make the following comments regarding the obviousness-type double patenting rejection.

As stated in MPEP §804, "A double patenting rejection of the obviousness-type is 'analogous to [a failure to meet] the non-obviousness requirement of 35 U.S.C. §103'....[t]herefore any analysis employed in an obviousness-type double patenting rejection parallels the guidelines for analysis of a 35 U.S.C. §103 obviousness determination."

Section 804 of the MPEP also states that any obviousness-type double patenting rejection should make clear (a) the differences between the inventions defined by the conflicting claims and (b) the reasons why a person of ordinary skill in the art would conclude that the invention defined in the claim in issue is an obvious variation of the invention defined in the claimed patent.

A comparison of the claims in the Tong patent and the presently amended claims reveals several key differences which illustrate that all of the present claims do not broadly encompass the Tong claims nor are they an obvious variation of the Tong claims. Primarily, as discussed in detail above, the presently amended claims recite a method whereby the electrically conductive layer is etched prior to the formation of a plurality of bumps on the un-removed portions of the electrically conductive layer. To the contrary, all of the claims of the Tong patent recite forming a plurality of bumps on the under bump metallurgy layer above the bonding pads and then etching the nickel-vanadium layer. Thus, the claims of the present invention and the Tong patent are clearly distinguishable and not obvious variations of each other.

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Additionally, Tong provides a bump fabrication process wherein a solution containing sulfuric acid with a concentration in the range of about 0.5% to about 50% is used as an etchant for etching only the nickel-vanadium layer. To the contrary, the present invention recites using a sulfuric acid solution having a concentration in the range of about 50% to about 96% to etch away portions of the adhesive layer. Further, while the Tong claims only recite removing a nickel-vanadium layer by using an etchant comprising sulfuric acid and de-ionized water, the presently amended claims recite first removing residual portions of the electrically conductive layer disposed above the bonding pads and then a second step of removing portions of the adhesive layer not covered by the bumps through the use of an etchant, wherein the etchant is sulfuric acid solution with a concentration range from about 50% to about 96%. Therefore the claims recited in Tong and the claims of the present invention are further differentiated.

In view of the above comments and further amendments to the claims, favorable reconsideration and allowance of all of the claims now present in the application are most respectfully requested.

Respectfully submitted,

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